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Indian Standard

SEMICONDUCTOR DEVICES — INTEGRATED CIRCUITS

PART 5 ANALOGUE INTEGRATED CIRCUITS — ESSENTIAL RATINGS AND CHARACTERISTICS

Section 5 Voltage and Current Regulators

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CONTENTS

PAGE

1 SCOPE 1

2 REFERENCES 1

3 TERMINOLOGY 1

4 LETTER SYMBOLS 1

5 FUNCTION 1

6 DESCRIPTION OF CIRCUIT 1

7 RATINGS (LIMITING VALUES) 1

8 RECOMMENDED OPERATING CONDITIONS (WITHIN THE SPECIFIED TEMPERATURE RANGE) 2

9 ELECTRICAL CHARACTERISTICS 2

10 MECHANICAL CHARACTERISTICS AND OTHER DATA 4

11 APPLICATION DATA 4

FOREWORD

This Indian Standard (Part 5/Sec 5) was adopted by the Bureau of Indian Standards, after the draft finalized by the Semiconductor Devices and Integrated Circuits Sectional Committee had been approved by the Electronics and Telecommunication Division Council.

This standard is one of a series of standards on integrated circuits. Other sections of this part are:

Section 1 General
Section 2 Operational amplifier
Section 3 Audio amplifier, video amplifier and multichannel amplifiers for telecommunication
Section 4 R. F. and I. F. amplifiers
Section 5 Voltage and current regulator
Section 6 Analogue switching circuits

This standard is based on IEC Pub 748-3 'Semiconductor devices, integrated circuits : Part 3 Analogue integrated circuits', issued by the International Electrotechnical Commission (IEC).

In reporting the results of a test or analysis made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'.

Indian Standard

SEMICONDUCTOR DEVICES — INTEGRATED CIRCUITS

PART 5 ANALOGUE INTEGRATED CIRCUITS — ESSENTIAL RATINGS AND CHARACTERISTICS

Section 5 Voltage and Current Regulators

1 SCOPE

This standard (Part 5/Sec 5) covers the essential ratings and characteristics for voltage and current regulators of analogue integrated circuits.

2 REFERENCES

The following Indian Standards are necessary adjuncts to this standard:

IS No.	*Title*
1885 (Part 7/Sec 5) : 1971	Electrotechnical vocabulary: Part 7 Semiconductor devices, Section 5 Integrated circuits and microelectronics
3715 (Part 1) : 1971	Letter symbols for semiconductor devices : Part 1 General aspects (*first revision*)
12970 (Part 1) : 1990	Semiconductor devices — Integrated circuits : Part 1 General

3 TERMINOLOGY

For the purpose of this standard terms and definitions given in IS 1885 (Part 7/Sec 5) : 1971, and provisions 3 of IS 12970 (Part 1) : 1990 shall be applicable.

4 LETTER SYMBOLS

For the purpose of this standard, letter symbols given in IS 3715 (Part 1) : 1971 shall be applicable.

5 FUNCTION

Regulators intended to be fed with an input d. c. voltage, in order to deliver a regulated output voltage (or current) which is either controllable by external elements or is fixed by internal elements.

6 DESCRIPTION OF CIRCUIT

6.1 Technology

The technology used in the manufacture should be stated, for example, semiconductor monolithic integrated circuit, thin film integrated circuit, hybrid integrated circuit, microassembly, etc.

6.2 Details of Outline and Encapsulation

6.2.1 Where applicable reference to standard outlines and bases (*see* IS 5000 Series) or outlines and base drawing showing dimension and tolerances should be given.

6.2.2 *Method of Encapsulation*

6.2.3 *Method of Identifying Terminals*

6.2.3.1 Terminal marking to be provided on the encapsulation.

6.3 Block-Diagram and Terminal Connections

The block-diagram and the identification of the connections should be shown on the same drawing. If the encapsulation has metallic parts, any connection to them from external terminals should be indicated.

An external elements required should be specified preferably with method of calculation of the values and their connections to the terminals of device should be stated.

As additional information, the complete electrical diagram can be reproduced, including significant parasitic elements, but not necessarily with indications of the value of the circuit components.

7 RATINGS (LIMITING VALUES)

7.0 The ratings given must cover the operation of the integrated circuit over the specified range of operating temperatures. Where such ratings are temperature-dependent, this dependence should be indicated.

7.1 Electrical Limiting Values

7.1.1 *Input Voltage*

a) Maximum value(s) and polarity, under continuous operation (including ripple).

b) Maximum value of transient input voltage for a specified duration.

c) Maximum value of permissible voltage between each input terminal and case or a reference terminal where appropriate.

7.1.2 *Voltage Difference Between Input and Output*

Maximum values.

7.1.3 *Load Currents*

Maximum values.

7.1.4 *Other Currents (for Example, from a Voltage-Reference Source)*

Maximum values.

7.1.5 *Short-Circuit Conditions*

Any limiting conditions (for example, time, current) for which a short circuit can be applied.

7.2 Temperatures

7.2.1 *Operating Temperatures*

Minimum and maximum values of ambient or reference-point operating temperature.

7.2.2 *Storage Temperatures*

Minimum and maximum values.

7.3 Power Dissipation

A curve of maximum power dissipation versus ambient or reference-point temperature.

8 RECOMMENDED OPERATING CONDITIONS (WITHIN THE SPECIFIED TEMPERATURE RANGE)

8.0 For **8.1** to **8.5**, the variation with temperature should be stated, where appropriate.

8.1 Input Terminals

Minimum and maximum values of input voltage range.

8.2 Output Terminals

8.2.1 *Voltage Regulators*

Output current range and, where appropriate, load resistance and load capacitance and/or inductance. Maximum rate of change of output current.

8.2.2 *Current Regulators*

Output current range and, where appropriate, load resistance and load capacitance and/or inductance. Maximum rate of change of the output voltage.

8.3 Bias Terminals

Value(s) of the bias and recommended bias networks, where appropriate.

8.4 External Elements

Value(s) and tolerance(s) of the external elements that must be associated with the circuit.

8.5 Voltage Difference Between Input and Output (Where Appropriate)

Minimum value.

9 ELECRICAL CHARACTERISTICS

9.1 Electrical characteristics should be stated as follows:

a) If external elements are essential for the operation of the circuit, the values of the electrical characteristics should be given with the specified external elements connected.

b) If external elements are optional only, the electrical characteristics should be given for the integrated circuit alone. The effect on the characteristics of adding specified external elements should then be indicated in application data.

9.1.1 *Characteristics at 25°C (Ambient or Reference-Point Temperature)*

In **9.1.1**, **9.1.2**, **9.1.3**, and **9.1.4**, either formula (I) or (II) should be choosen consistently throughout.

9.1.2 *Input Regulation Coefficient (Formula I) or Input Stabilization Coefficient (Formula II) (for a Voltage Regulator)*

(I) $(\Delta V_0/V_0)$

(II) $(\Delta V_0/V_0) / (\Delta V_1/V_1)$

Typical and maximum values for specified values of :

a) input voltage range, either as a single range or as multiple ranges covering the full range of **8.1**,

b) nominal input voltage V_1 (for example formula II only),

c) load current, and

d) nominal ouput voltage V_0 (where the quantity is adjusted by external elements).

9.1.3 *Input Regulation Coefficient (Formula I) or Input Stabilization Coefficient (Formula II) (for a Current Regulator)*

(I) ($\Delta I_0/I_0$)

(II) ($\Delta I_0/I_0$) / ($\Delta V_1/V_1$)

Typical and maximum values for specified values of:

a) input voltage range, either as a single range or as multiple ranges covering the full range of **8.1**;

b) nominal input voltage V_1 (for example formula II only);

c) nominal load current I_0; and

d) load impedance.

9.1.4 *Load Regulation Coefficient (Formula I) or Load Stabilization Coefficient (Formula II) (for a Voltage Regulator)*

(I) ($\Delta V_0/V_0$)

(II) ($\Delta V_0/V_0$) / ($\Delta I_0/I_0$)

Typical and maximum values for specified values of :

a) output current range, either as a single range or as multiple ranges covering the full range of **8.2.1**;

b) nominal load current I_0 (for formula II only);

c) input voltage;

d) nominal output voltage V_0 (where this quantity is adjusted by external elements); and

e) external resistors, where appropriate.

9.1.5 *Load Regulation Coefficient (Formula I) or Load Stabilization Coefficient (Formula II) (for a Current Regulator)*

(I) ($\Delta I_0/I_0$)

(II) ($\Delta I_0/I_0$) / ($\Delta R_l/R_L$)

Typical and maximum values for specified values of :

a) load impedance range, either as a single range or as multiple ranges covering the full range of **8.2.2**;

b) nominal load impedance R_l (for formula II only);

c) input voltage;

d) nominal output current I_0; and

e) external resistors, where appropriate.

9.1.6 *Ripple Rejection Ratio of Input Voltage*

Minimum value, in decibels, for specified values of:

a) ripple frequency(ies), and

b) by-pass capacitance between reference terminal and ground.

9.1.7 *Stand-by Current (or Quiescent Current)*

Minimum and maximum values of the supply current drawn by the regulator under no-load conditions, where appropriate, for specified values of :

a) input voltage, and

b) external networks.

NOTE — The current through these external networks which produces the reference voltage is neglected.

9.1.8 *Reference Voltage (Where a Reference Terminal Exists)* (V_{ref})

Minimum and maximum values.

9.1.9 *Short-Circuit Current (for Voltage Regulators only)* (I_{OS})

Minimum value for specified values of :

a) current-limiting resistor, where appropriate;

b) input voltage; and

c) time duration of short circuit conditions, where appropriate.

9.1.10 *Pulse Operation*

Maximum values of the amplitude of the output voltage deviation (for voltage regulators) or of the current deviation (for current regulators) and maximum value of the time required to return within a given percentage of the final value of the output voltage or current, for a specified step in:

a) input voltage; and

b) output current or load impedance, respectively, for specified load resistance and capacitance, current respectively, and for specified values of limiting network, and/or frequency compensation network where appropriate.

9.1.11 *Output Noise Voltage* (V_{no}, V_{nopp})

Maximum value.

Noise should be specified as overall noise voltage, for specified values of:

a) input voltage,
b) output current,
c) by-pass capacitors, and
d) frequency and bandwidth.

9.1.12 *Output Voltage (Appropriate only if this Quantity is Fixed by Internal Elements)* (V_0)

Minimum typical and minimum values for specified values of :

a) input voltage, and
b) load current.

9.2 Effects of Variation of Temperature on the Essential Characteristics

9.2.1 *Variation of Some Characteristics with Temperature, Temperature Coefficients*

a) Input regulation (or stabilization) coefficient (for a voltage regulator) (*see* **9.1.1**);
b) Input regulation (or stabilization) coefficient (for a current regulator) (*see* **9.1.2**);
c) Load regulation (or stabilization) coefficient (for voltage regulator) (*see* **9.1.3**);
d) Load regulation (or stabilization) (coefficient (for a current regulator) (*see* **9.1.4**);
e) Output voltage, when specified (*see* **9.1.11**);
f) Temperature coefficient of regulated output voltage (for a voltage regulator), and

$$(\Delta V_0/V_0) \times (I/\Delta t)$$

Maximum value for specified values of :

1 temperature range (this range being expressed by stating its low limit and high limit),
2 input voltage,
3 load current, and
4 output voltage.

g) Temperature coefficient of regulated output current (for a current regulator)

$$(\Delta I_0/I_0) \times (I/\Delta t)$$

Maximum value for specified values of :

1 temperature range (this range being expressed by stating its low limit and high limit),
2 input voltage,
3 load impedance, and
4 output current.

10 MECHANICAL CHARACTERISTICS AND OTHER DATA

10.1 Provisions of **5.5** of IS 12970 (Part 1) : 1990 shall apply.

10.2 Special precaution if any required to handle during storage, assembly and transport, etc.

11 APPLICATION DATA

Under consideration.

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The use of the Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act, 1986* and the Rules and Regulations made thereunder. The Standard Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well defined system of inspection, testing and quality control which is devised and supervised by BIS and operated by the producer. Standard marked products are also continuously checked by BIS for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

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